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ABSTRACT

A series of occupational competency tests representing all seven vocational education curriculum areas were developed, field tested, and validated. Seventeen occupations were selected for competency test development: agricultural chemicals applications technician, farm equipment mechanic, computer operator, word processing specialist, apparel sales, fabric sales, grocery clerk, hotel (motel) front office, dental assistant, physical therapist assistant, custom sewing, restaurant service (waiter, waitress, and cashier), electronics technician, water treatment technician, wastewater treatment technician, carpenter, and diesel mechanic. Identification of competencies involved development of a task inventory and task verification through interviews in the field. Test items were reviewed by experts representing vocational educators and employers, and the tests were revised and pilot tested. Over 3500 students in more than 150 sites in 37 states participated in the field testing. Contents of the final test packages were a job information (paper-and-pencil) test, a complete set of hands-on performance tests, a Work Habits Inventory (a teaching and counseling tool in job survival skills), and an Examiner's Manual. Test reliability and validity were also investigated, and a wide range of dissemination activities were undertaken to stimulate test usage and additional test development. Appendixes include a copy of the Work Habits Inventory. (YLB)

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DEVELOPMENT AND EVALUATION OF VOCATIONAL COMPETENCY MEASURES

FINAL REPORT

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Albert B. Chalupsky
Project Director

ABSTRACT

Between October 1979 and December 1982, the American Institutes for Research was engaged in a nationwide effort to develop, field test, and validate 17 occupational competency tests under the sponsorship of the U. S. Department of Education. Other goals of the project were to promote the acceptance of student competency testing in vocational education and to help stimulate the continuing development of occupational competency tests.

After extensive interaction with many leaders in vocational education, the following occupations were selected for competency test development:

Agriculture - Agricultural Chemicals Applications Technician, Farm Equipment Mechanic
Business and Office - Computer Operator, Word Processing Specialist
Distributive Education - Apparel Sales, Fabric Sales, Grocery Clerk, Hotel (Motel) Front Office
Health - Dental Assistant, Physical Therapist Assistant
Home Economics - Custom Sewing, Restaurant Service (Waiter, Waitress, Cashier)
Technical - Electronics Technician, Water Treatment Technician, Wastewater Treatment Technician
Trade and Industry - Carpenter, Diesel Mechanic

The competency tests are intended to serve two major purposes: (1) to help teachers and administrators of secondary and postsecondary vocational education programs evaluate and improve specific areas of their vocational programs, and (2) to provide an objective basis for informing students, teachers, and prospective employers about the progress made by students in acquiring specific, job-related competencies. Employers may also find the tests useful for helping in selecting new employees and assessing objectively the training needs of present employees.

Each test package includes the following items:

- paper-and-pencil test: two parts, each part requiring no longer than one class period to administer
- a complete set of the "hands-on" performance tests for that occupation, each test containing examiner and examinee instructions, appropriate test props, and a test record sheet; the number of performance tests in each package ranges from 4 to 13
- Work Habits Inventory, for use as a teaching and counseling tool in job survival skills
- an Examiner's Manual, including directions for test administration, a summary of how the tests were developed, technical data on test reliability and validity, and scoring keys for the tests and the Work Habits Inventory

The results of the field testing and validation have shown that:

1. All of the competency tests demonstrated good to excellent reliabilities.

2. The employer appraisal of test relevance--our primary measure of the relevance of the tests to job requirements--indicated that the content of each of the tests was rated important to the job.

3. For most of the Job Information Tests, where adequate data were available, the employees with substantial amounts of experience scored higher on the average than those with less experience, who in turn scored higher than individuals in training. Those with neither training nor experience scored the lowest.

To stimulate increased usage of student competency measures in vocational education and the development of additional measures, a wide range of dissemination activities was undertaken, including the preparation of a report on the state of the art of competency measurement in vocational education and four instructional manuals covering the effective use of occupational competency measures, their development, and their validation.

INTRODUCTION

In the fall of 1979, the American Institutes for Research (AIR) responded successfully to a request for proposals (RFP) from what is now the Office of Vocational and Adult Education of the U.S. Department of Education. This RFP, issued largely in response to requests from State Directors of Vocational Education, called for the design, development, field test, and dissemination of a series of occupational competency measures representing all seven vocational education curriculum areas.

The competency tests are intended to serve two major purposes: (1) to help teachers and administrators of secondary and postsecondary vocational education programs evaluate and improve specific areas of their vocational programs, and (2) to provide an objective basis for informing students, teachers, and prospective employers about the progress made by students in acquiring specific, job-related competencies. Employers may also find the tests useful for helping in selecting new employees and assessing objectively the training needs of present employees.

The specific objectives of the project were as follows:

- to develop competency tests in selected occupations representing all seven vocational curriculum areas
- to establish their usefulness through extensive field testing and validation
- to promote their acceptance and use in vocational education programs
- to design and help implement a program for continuing occupational competency test development on a self-supporting basis

To help in the planning and implementation of the project, AIR was assisted by two advisory groups: the project National Policy Council and the National Subject Matter Panel. The 18-member National Policy Council advised on overall project design, including methods for field testing and validation and strategies for dissemination.

The 14-member National Subject Matter Panel advised project staff on criteria for occupational selection and recommended technical reviewers of the test items. Wherever appropriate, subject matter panelists also served as test reviewers.

The members of each advisory group are listed in Appendix A.

The purpose of this report is to summarize the major activities undertaken during the course of the Vocational Competency Measures (VCM) project. We should emphasize, however, that the primary justification for the project is the series of 17 occupational competency test packages produced under the contract. Contents of these test packages are described in a later section.

SELECTION OF OCCUPATIONS FOR TEST DEVELOPMENT

Our process for selecting occupations reflected several general factors. First was our concern that the areas selected should lead to tests that would be accepted by and useful to the vocational educators in all states, both as measures of student competency and as stimuli for curriculum and instructional development. Second were the recommendations made by our National Policy Council, our National Subject Matter Panel, State Directors of Vocational Education or their representatives, and other leaders in vocational education. The resulting criteria were a composite of those perspectives.

Our initial goals were to select:

- two occupations representing <u>each</u> of the seven vocational curriculum areas: agriculture, business and office, distributive education, health, home economics, technical, trade and industry[1]
- occupations representing differing principal segments <u>within</u> a given area
- occupations in which opportunity for employment is favorable and for which there are ample enrollments, or occupations in emerging areas that may not yet have high enrollments but where the trend is upward
- occupations in which "adequate" competency tests (including performance components) are not available to vocational educators or currently under development
- occupations where vocational training is necessary (as opposed to unskilled entry-level occupations in which there is high turnover of temporary help)
- occupations where there is a good consistency in the content across different geographical regions (to assure national rather than strictly regional applicability)
- occupations that, in the aggregate, would represent a range of diverse models to guide future developers of tests beyond the original tests that AIR would prepare

---

[1] This was expanded to 17 occupations as will be described later.

The AIR project staff communicated extensively with the project's National Policy Council and with its National Subject Matter Panel. Both groups gave us a vote of confidence that our procedures for selecting occupations were reasonable and fair. Following these criteria, project staff reviewed many possible occupations that seemed worthy of consideration for the development of competency tests that would be applicable across the nation, including cognitive, affective, and performance dimensions.

As we began to focus on specific occupational choices in each of the seven areas, we communicated by telephone with Panel members, with selected Council members, with authorities in the particular occupations, with resource centers, such as the Vocational-Technical Education Consortium of the States (V-TECS) and the Mid-America Vocational Curriculum Consortium (MAVCC), and with selected state leaders in vocational education. In the course of this search, we found a number of areas that, because of overlap, lack of universal appeal and consistency, or other reasons, were then dropped from consideration.

In order to rank occupations in order of priority for possible competency test development, it was clearly advisable that a comparative analysis be undertaken of vocational education enrollment, labor trends, employee turnover, and vocational complexity levels. Using appropriate references from the Bureau of the Census, the Bureau of Labor Statistics, and the then U.S. Office of Education, a draft table was constructed containing this information for selected high-enrollment programs in each of the seven vocational areas. Also included in each table was preliminary information on the current and projected availability of competency measures for specific occupations. The table for each area was sent to the two Panelists representing that specialty, along with an outline of our proposed strategy for occupational selection. Panel members were asked to appraise our strategy, to recommend specific occupations for test development, and to provide additional information and leads to other sources.

In order not to delay the project schedule, it was necessary to select three occupations for initial test development. Prior to our final selection

of the first three occupations, we conferred with the current and past presidents of the National Association of State Directors of Vocational Education, and obtained the approval of the Project Officer. After this initial selection had been completed, a letter was sent to all State and Territorial Directors of Vocational Education informing them of the first three occupations selected for test development (and the criteria for their selection) and requesting their recommendations for the remaining occupations. Responses were received from 19 states and outlying territories.

Selection of the remaining occupations proceeded in increments, with the final increment being submitted and approved by the Project Officer in June 1980. The procedures for selection were similar to those followed earlier and consisted of analysis of enrollments and labor projections; identification of available performance-centered tests and task inventories; and review of nominations from the National Policy Council members, National Subject Matter Panelists, and State Directors. Discussions with program specialists in the Office of Vocational and Adult Education, with leaders in professional associations and related governmental agencies, and current and past presidents of the National Association of State Directors of Vocational Education also helped to clarify the priorities among alternative areas.

In accordance with our objectives, a total of 14 occupations were selected for test development. Based on experience gained during our data collection, two occupations were subdivided to reflect more closely actual job content, resulting in a total of 17 occupational test packages. The final list of occupations selected for test development is shown in Table 1.

TABLE 1

Occupational Areas Covered in
the AIR Vocational Competency Tests

- **AGRICULTURE**
  - Agricultural Chemicals Applications Technician
  - Farm Equipment Mechanic
- **BUSINESS AND OFFICE**
  - Computer Operator
  - Word Processing Specialist
- **DISTRIBUTIVE EDUCATION**
  - Apparel Sales
  - Fabric Sales
  - Grocery Clerk
  - Hotel (Motel) Front Office
- **HEALTH**
  - Dental Assistant
  - Physical Therapist Assistant
- **HOME ECONOMICS**
  - Custom Sewing
  - Restaurant Service (Waiter, Waitress, Cashier)
- **TECHNICAL**
  - Electronics Technician
  - Water Treatment Technician
  - Wastewater Treatment Technician
- **TRADE AND INDUSTRY**
  - Carpenter
  - Diesel Mechanic

IDENTIFICATION OF COMPETENCY REQUIREMENTS

Identifying the competencies in each of the selected occupations consisted of five stages:

- Gathering background data on selected occupations
- Developing interview instruments and checklists
- Conducting interviews and gathering task verification information in the field
- Analyzing obtained information
- Summarizing and prioritizing findings for test development

For each occupation selected, the above stages were followed in identifying required job competencies.

Gathering Background Data on Selected Occupations

The first step was to gather existing inventories of the tasks performed in these occupations. All available avenues (published sources, governmental sources, military sources, personal contacts) were pursued, and a wide variety of inventories were obtained. These inventories were reviewed and a compilation of all nonredundant skills and knowledge was then developed for each occupation. For the initial 14 occupations, this acquisition and compilation task resulted in a rich foundation of information about competencies.

Developing Interview Instruments and Checklists

Each listing was then reformatted for use as a structured checklist that could be self-administered. The format used for all the task inventory surveys was kept similar for consistency in use and analysis.

A pilot test of the checklist was conducted at a sophisticated electronics firm and at an auto repair shop to determine its usability under widely varying circumstances and in diverse areas.

Each respondent was asked to provide information on task frequency, importance, and whether the task was learned on the job or before being hired. An excerpt from one of the checklists is shown below.

	Frequency				Importance			Learned	
	NOT DONE	WEEKLY	MONTHLY	QUARTERLY	HIGH	MODERATE	LOW	BEFORE	AFTER
1. Maintain hand tools.	___	___	___	___	___	___	___	___	___
2. Maintain power tools.	___	___	___	___	___	___	___	___	___
3. Maintain surveying instruments and equipment.	___	___	___	___	___	___	___	___	___

The checklist yielded information on the frequency and significance of the competencies as well as some idea of whether each could reasonably be assessed in a pre-employment school setting. Space was also provided for respondents to "write in" and rate additional tasks not covered in the task inventory survey.

The respondents were also asked to name personal qualities that they felt were important for the job in three general areas. These were:

- personal characteristics, such as being dependable
- work habits, such as starting work on time
- interpersonal relations, such as accepting supervisor's suggestions

Finally, the respondents were asked whether substantial parts of the job could be performed by persons with the following types of handicaps:

- orthopedic handicaps
- deaf or hard of hearing
- blind or visually impaired
- mentally retarded

When respondents completed the checklist they were asked to go over the list and circle up to 10 of the items that they felt were <u>most critical</u> to the job. The circled items were used as a check on the arranging of competencies in order of importance and the selection of those to be developed into performance tests.

A general interview guide was also prepared for use in conjunction with the task inventory checklist. This guide gave suggestions for open-ended prompts for use by the AIR representative.

Conducting Interviews and Gathering Task Verification Information in the Field

Once the task inventory and interview forms were developed, arrangements were made to interview supervisors and workers throughout the country. For all the occupations selected, a conscious effort was made to get a distribution of different-sized companies and businesses to eliminate any possible bias that could exist due to size. Diversity was also sought in the type of business that utilized workers in a particular occupation. It was felt that, for example, a diesel mechanic repairing tractor engines may have a somewhat different perception of what tasks are important or most often done than a diesel mechanic repairing truck engines. Similarly, diversity was sought along geographic lines in an effort to avoid regional bias. For example, farm equipment differs regionally, yet we were interested in identifying competencies that were generalizable across the country.

Names and locations of possible firms were received from:

- National Policy Council members and National Subject Matter panelists
- State Directors of Vocational Education
- professional organizations

In scheduling site visits, efforts were made to cluster them for the various occupations in order to reduce travel costs as much as possible.

Altogether, our task verification phase involved interviews in 27 states and the District of Columbia. Table 2 shows the number of interviewees and states involved in the task verification of each occupation selected for test development. AIR representatives interviewed job incumbents and supervisors separately. Throughout, the interviewees were encouraged to expand on any additional competency areas that were especially important for performance appraisal.

Analyzing Obtained Information

Both quantitative and qualitative procedures were followed in analysis to assure maximum utilization of all the information that was collected. The general information obtained through interviews was qualitatively analyzed

TABLE 2

Number of Interviews and States Involved in the Gathering of Task Verification Information

Test Name	No. of Interviews	States Involved
Agricultural Chemicals Applications Technician	19	CA, GA, MO, NY, UT
Farm Equipment Mechanic	25	CA, NY, OH, OK, WI
Computer Operator	24	CA, IA, NY, OK
Word Processing Specialist	12	CA, IN, TX
Grocery Clerk	18	AL, AZ, CA, DC, VA
Hotel (Motel) Front Office	13	CA, MA, PA, SC
Dental Assistant	20	CA, NJ, NM, NY, OK
Physical Therapist Assistant	12	CA, IN, TX
Fashion/Fabric Sales and Sewing	17	CA, GA, IL, MO, RI
Restaurant Service (Waiter, Waitress, Cashier)	14	AL, CA, IL, MA, NY, PA, SC
Electronics Technician	16	CA, FL, MA, MD, TN
Water/Wastewater Technician	13	CA, FL, MA
Carpenter	14	CA, KY, MA, NM, NV, SC
Diesel Mechanic	12	AZ, CA, MD, MN

by test team leaders. This analysis helped to focus on topics that might be relevant to performance assessment, such as certain kinds of equipment used for particular tasks, criteria for judging quality performance, etc.

For the listing of items on the task inventory survey, the analysis procedure was more quantitative. For each task inventory item (typically around 100 per inventory), the ratings were separately summed and averaged for supervisors and job incumbents. The total score was then weighted to give responses from supervisors additional importance in the final weighting. (This is realistic both because of their greater experience and their function as evaluators of "new-hire" vocational trainees during their early months of employment.)

Inventory items where the weighted-average score indicated that the task was considered important, frequently performed, or both were then selected as areas for test item development. Excluded from test item development were those tasks considered less important or considered important only in a limited geographical region. On completion of the analysis, the summaries of the findings were then given to the test team leaders to begin developing the competency tests.

The final task inventories for each of the occupations selected for test development includes all tasks that were found to have even moderate importance in our task inventory survey or to have been performed at least on a monthly basis--not just the tasks that are covered in the AIR competency measures. These lists are being submitted to the East Central Network for Curriculum Coordination, a federally-sponsored national curriculum network located at Sangamon State University, Springfield, Illinois for inclusion in their data bank of task lists. The task lists will also be submitted to the Educational Resources Information Center (ERIC) of the U.S. Department of Education.

TEST DEVELOPMENT AND FIELD TESTING

This stage encompassed three major activities:

1. item development and tryout
2. pilot testing
3. field testing

Item Development and Tryout

For each test, AIR staff worked with two or more technical experts in preparing the final test outline and the individual test items. To further ensure that the tests reflect real job demands and, at the same time, are sensitive to the problems faced by vocational educators, each test was reviewed by three or more experts representing vocational educators, as well as employers not associated with the development of the test items. Technical reviews of each test were solicited from at least two regions of the country. Following test review, each test was revised.

Pilot Testing

Pilot testing consisted of tryouts of each test with a small group of students typically in two locations. Appendix B lists the schools participating in the pilot testing. We observed the students taking the test and then interviewed them, as well as their instructors, primarily to check on our administration procedures and our instructions and to get a preliminary estimate of time requirements of the tests.

Field Testing

The competency measures were then field tested in vocational education programs across the country. Two tryout forms of each test were developed for this purpose. Altogether, over 3,500 students in more than 150 sites in 37 states participated in this field testing. Included in this total were some 80 Air Force students at two technical training centers--Sheppard and Keesler Air Force bases--and a small number of students at several Navy and Marine bases.

For purposes of field test planning and coordination, it was convenient to use a geographical grouping of states already in existence--that of the National Network for Curriculum Coordination in Vocational and Technical Education (the NNCCVTE), as shown in Figure 1. Efforts were made to have each measure field tested in as many of the six regions as possible. Table 3 shows the number of schools, number of students, and regions represented in the field testing of each test.

The field tests were used primarily to collect item statistics for reducing the length of the tests and to a lesser extent for modifying items. In addition, the field tests provided one basis for estimating test reliabilities. Specifically for each test, the following kinds of item analysis data were obtained:

1. The mean score of the examinees reaching the item, on the section of the test that contained the item
2. The corresponding standard deviation
3. For <u>each response option</u> of each item:
   a. the number of examinees selecting the option
   b. the proportion of examinees selecting the option
   c. the mean score of those examinees on the corresponding section of the test
   d. the corresponding standard deviation
   e. <u>two</u> measures of the extent to which selecting that particular response was related to score on the test section
      (1) the point biserial correlation between selecting the option and score on the test section, and
      (2) the corresponding Brogden-Clemans[2] correlation

      (These measures are sometimes called indexes of item-test homogeneity, or internal consistency.)

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[2] Brogden, H. E. A new coefficient: Application to biserial correlation and to estimation of selection efficiency. <u>Psychometrika</u>, 1949, <u>14</u>(3), 169-182.

Clemans, W. V. An index of item-criterion relationship. <u>Educational and Psychological Measurement</u>, 1958, <u>18</u>(1), 167-172.

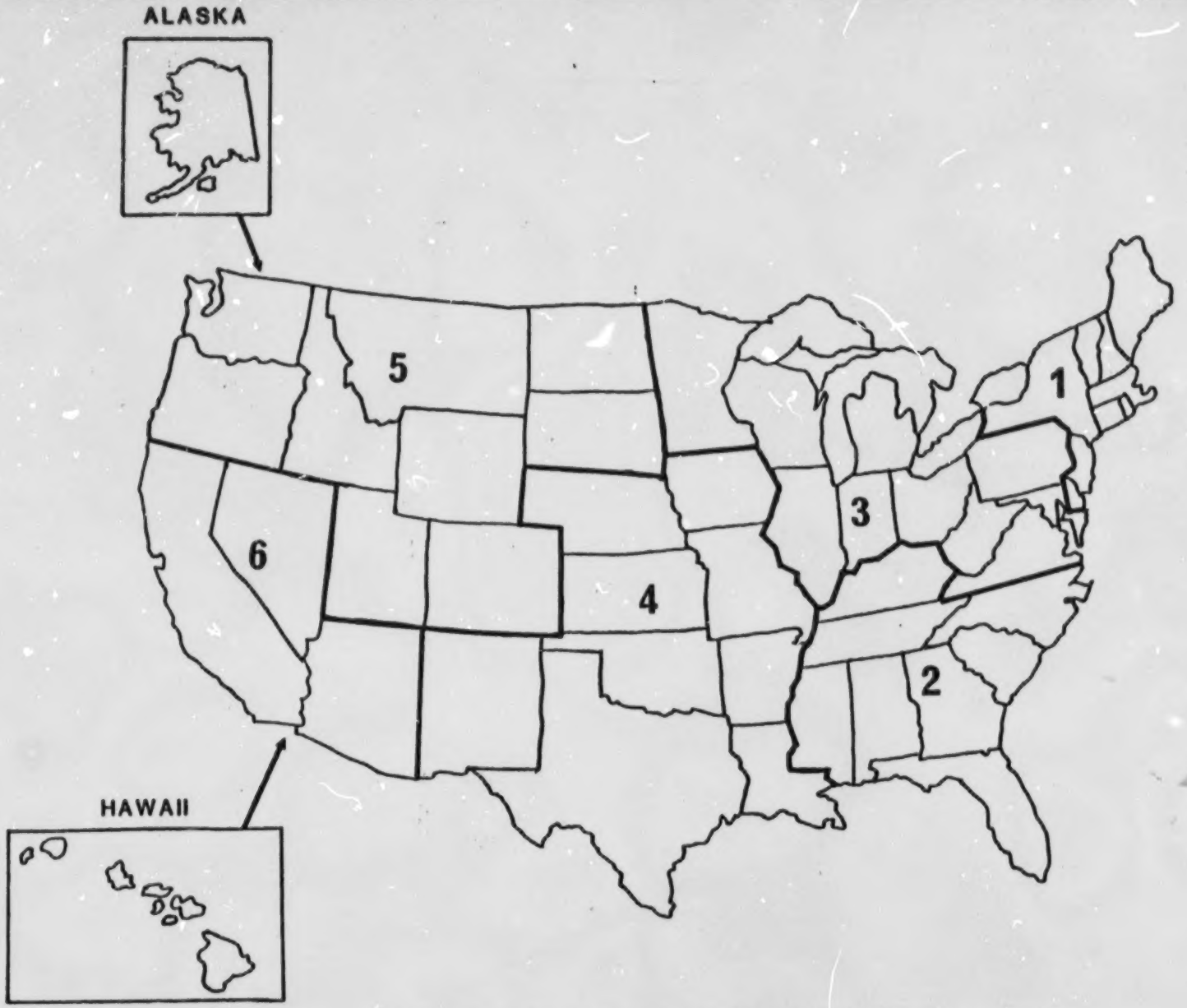

Figure 1. Map of the Regions in the National Network for Curriculum Coordination in Vocational Technical-Education (NNCCVTE).

TABLE 3

Field Test Participants by School and Region

PARTICIPATING IN FIELD TEST			REGIONS					
TEST	#SCHOOLS	#STUDENTS	1	2	3	4	5	6
AGRICULTURAL CHEMICALS APPLICATIONS TECHNICIAN	12	217			x	x	x	
FARM EQUIPMENT MECHANIC	9	191	x	x			x	x
COMPUTER OPERATOR	9	203	x	x	x		x	x
WORD PROCESSING SPECIALIST	12	262	x	x	x	x	x	x
APPAREL SALES	7	138	x		x	x		x
FABRIC SALES	7	138	x		x	x		x
GROCERY CLERK	8	167	x		x	x	x	x
HOTEL (MOTEL) FRONT OFFICE	13	298	x	x	x	x	x	x
DENTAL ASSISTANT	16	379	x	x		x	x	x
PHYSICAL THERAPIST ASSISTANT	14	237	x	x	x	x	x	x
CUSTOM SEWING	7	138	x		x	x		x
RESTAURANT SERVICE (WAITER, WAITRESS, CASHIER)	12	238	x	x	x	x	x	x
ELECTRONICS TECHNICIAN	16	403	x		x	x	x	x
WATER TREATMENT TECHNICIAN	12	330	x	x	x	x	x	
WASTEWATER TREATMENT TECHNICIAN	12	330	x	x	x	x	x	
CARPENTER	12	302	x		x	x	x	x
DIESEL MECHANIC	8	186	x		x	x	x	x

In interpreting the data resulting from the item analysis, it was considered important that the items selected for the final form represent a good spread of item difficulties and that the correlations between item response and total test section score be positive and substantial for the right answer and either negative or close to zero for each distractor, and also for item omission. At least as important was the distribution of item content, which had to be such that the final form of the test would conform to the same specifications as the tryout forms.

Contents of the Final Test Packages

Each test package includes the following:

- job information (paper-and-pencil) test; two parts, with each part requiring no longer than one class period to administer
- a complete set of the "hands-on" performance tests for that occupation; each test containing examiner and examinee instructions, appropriate test props, and a test record sheet (The number of performance tests in each package ranges from 4 to 13.)
- Work Habits Inventory
- an Examiner's Manual, including directions for test administration, a summary of how the tests were developed, technical data including test reliability and validation information, and the scoring keys for the tests and the Work Habits Inventory

To illustrate what a typical test package looks like, the Computer Operator test will be described. The Work Habits Inventory will be discussed in a later section.

The Job Information Test. Each test is organized into two parts, each part taking about 45 minutes or less. We strongly encourage administering both parts to each student, particularly when using the test for making decisions about an individual student at the completion of training, or when using the test to identify areas where an individual needs further training. On the other hand, there may be occasions when only one part of the test need be administered to any one individual, for example, when the test is used as an overall progress measure, or as a program evaluation tool.[3]

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[3] For two of the tests, Word Processing Specialist and Water Treatment Technician, both parts must be taken.

The job information test is organized by major topic or section. For purposes of illustration, the organization of the Computer Operator Job Information Test is shown below:

Section A. General Concepts
Section B. Storage Media
Section C. Peripherals
Section D. Routine Operations
Section E. Troubleshooting
Section F. Auxiliary Equipment
Section G. The Computer Operator's Job

All of the items in the job information test are multiple choice, with the great majority of the items having five choices.

Performance tests. In the Computer Operator Test package there are four performance tests that require the examinee to actually carry out some of the entry-level activities expected of a computer operator. They range in time required from an estimated 2 minutes to 65 minutes. The tests require only the equipment and materials normally available in a school offering computer operator training or at any business or other organization employing computer operators. Together, the tests cover a range of activities commonly performed by computer operators in entry-level jobs; however, it is not expected that all examinees must necessarily be tested on the entire set.

The decision as to what performance tests to administer will depend on the uses that will be made of the test scores. It is suggested that this decision be made in conjunction with the appropriate school administrators and members of employer advisory committee, after a careful review of the entire set of performance tests.

All performance tests should be monitored by qualified instructors of computer operator programs, who record their appraisals of task performance on specially designed Performance Test Record Sheets. In Figure 2 is shown the test record sheet for one of the sub-tests of the Computer Operator test, "operate card reader and console," which is a part of the major task entitled "Job Stream: card-to-tape, tape-to-disk, sort-on-disk, disk-to-printer."

COMPUTER OPERATOR TEST

Performance Test 3e: Operate Card Reader and Console

Performance Test Record Sheet 3e

Examinee_____ Examiner_____ Date_____
Month Day Year

School/Employer_____

Start Time_____

Observe the examinee's performance and record observations for each of the tasks below. After test is completed, check the items listed under Outcomes.**

		Yes	No	NA
CARD READER OPERATION				
1. Fans deck before loading	1.			
2. Joggles deck immediately before loading	2.			
3. Uses non-process runout appropriately	3.			
4. Presses end-of-file key at beginning	4.			
5. Invalid card:				
a. Recognizes card is invalid	5a.			
b. Makes replacement card according to instructions (i.e., follows interpretation)	5b.			*
c. Sight-checks replacement card	5c.			*
CONSOLE				
6. Responds promptly and correctly to console messages	6.			
7. Uses reference manual as necessary	7.			
8. States what job step is executing				
a. First query	8a.			
b. Second query	8b.			
OUTCOME**				
9. Replacement card is correct (i.e., free of punching errors)	9.			
EXAMINER: Sight-check the replacement card against the invalid card.				

Finish Time:_____

Note to Examiner:

[Invalid card contains punches 1, 5, 7, 9 in Column 4. Replacement card should be identical except that it should contain just a 5 in Column 4.]

Score:_____
(No. of checks in Yes column)

*Keypunch not available

**After this record sheet has been completed, Performance Test Record Sheet #3d/3f (Mount and Dismount Printer Forms) Item 8 should be completed.

Figure 2. Excerpt from Computer Operator Performance Test

ESTIMATING THE RELIABILITY OF THE TESTS

The first empirical evidence that the tests were going to prove highly reliable was provided by the reliability coefficients obtained for the tryout version of the tests, by correlating one tryout form with the other and then treating these forms as half-tests and getting the reliability of the total. These coefficients[4] ranged from .84 to .96, with most of the tests having a reliability exceeding .90. However, reliability of the tryout forms is obviously of less concern than reliability of the final form. To obtain the latter, two different approaches were used. The first was to rescore the tryout data, to obtain scores based only on those items retained in the final form. The second was to use the "validation study data" (the data obtained by administering the final forms of the tests to employees in appropriate jobs).

Neither of these approaches is perfect, but each has its own advantages. The rescoring approach gives somewhat more stable results since the numbers of cases are larger. However, it has the disadvantage that because the tryout data played a part in the selection of the final items, there may be a slight spurious element in the reliabilities based on rescored data.

The validation data (employee data) are entirely free of this problem, but they have the major drawback that the numbers of cases for many of the tests are quite small, and the further disadvantage that each examinee took only one part of the test, thus necessitating more assumptions in estimating reliability coefficients for total scores (the sum of the two parts), and probably causing at least a slight spurious increase in some of the coefficients.

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[4] For these reliability coefficients, as for all subsequent reliabilities obtained by correlating half-tests, the correction formula used was Angoff Formula 16 (Angoff, W. H. Test reliability and effective test length. Psychometrika, 1953, 18, 1-14) wherever possible rather than the more familiar Spearman-Brown formula, because the Angoff formula is somewhat more accurate, not requiring the usually incorrect assumption that the two test halves have equal standard deviations.

The reliability coefficients for each test (final form) are shown in Table 4 along with the number of cases on which they are based and the number of items in the test.

Any sizable discrepancies between corresponding reliability coefficients, though partly due to sampling errors and partly artifactual in nature, are probably due primarily to differences in variability of the two groups.

TABLE 4

Reliability Coefficients and Related Data

Test Name	Number of test items in final form			Data based on students in field-test tryout (rescored as final form)					Data based on employees in validation study							
						Reliab. for Total (I + II)			No. of Employees		Standard Deviations		Reliability Coefficients			
	Part I	Part II	Total	No. of Students	Corr. Between Parts I & II	Based on Col. 6	Split-half	S.D. of Total	Part I	Part II	Part I	Part II	Part I	Part II	Total[d] Based on Part I	Total[d] Based on Part II
(1)	(2)	(3)	(4)	(5)	(6)[a]	(7)[b]	(8)[c]	(9)	(10)	(11)	(12)	(13)	(14)[c]	(15)[e]	(16)	(17)
Agricultural Chemicals Applications Technician	53	53	106	175	.80	.89	.94	16.35								
Farm Equipment Mechanic	54	54	108	166	.86	.93	.96	21.45								
Computer Operator	56	56	112	168	.88	.94	.95	19.57	52	43	5.74	6.08	.77	.65	.87	.79
Word Processing Specialist			150	245			.95	21.00	78	78						.90[e]
Apparel Sales	49	49	98	98	.64	.79	.90	11.61								
Fabric Sales	50	51	101	98	.73	.85	.93	14.82								
Grocery Clerk	55	53	108	158	.88	.94	.92	17.00	46		6.03		.78		.87	
Hotel (Motel) Front Office	53	53	106	260	.78	.87	.93	17.68								
Dental Assistant	56	56	112	332	.90	.95	.96	21.91	90	71	5.40	5.45	.74	.69	.85	.82
Physical Therapist Assistant	54	54	108	225	.89	.94	.93	16.80	33	47	5.31	6.12	.53	.78	.69	.88
Custom Sewing	50	51	101	98	.83	.91	.96	18.20								
Restaurant Service (Waiter, Waitress, Cashier)	61	61	122	204	.85	.92	.97	26.38	22	34	9.59	7.93	.87	.90	.93	.95
Electronics Technician	53	53	106	328	.92	.96	.96	22.58	144	112	8.33	7.62	.88	.83	.94	.91
Water Treatment Technician	45	45	90	239	.81	.89	.95	16.77	80	75	6.38	6.70	.82	.83	.90	.91
Wastewater Treatment Technician	53	53	106	239	.75	.86	.95	18.37	77	79	6.73	5.13	.83	.80	.91	.89
Carpenter	55	55	110	282	.90	.95	.96	21.02	50	13	7.01	f	.81	f	.89	f
Diesel Mechanic	54	54	108	179	.92	.96	.94	20.28	53	29	8.15	6.20	.87	.68	.93	.81

[a] This is the approximate reliability for Part I and for Part II. It is analogous to "parallel forms reliability."

[b] Correlation between parts corrected by Angoff formula #16 (Angoff, W.H. Test reliability and effective test length. Psychometrika, 1953, 18, 1-14)

[c] Split-half reliability coefficients, corrected by Angoff formula #16

[d] Part I or Part II reliability (from columns 14-15) corrected by Spearman-Brown formula to give reliability of the total test.

[e] Split-half reliability based on total test

[f] Too few cases

TEST VALIDATION

The extent to which the tests were valid was investigated by determining:

1. How well the information and tasks measured by the tests matched job requirements (content validation).

2. How well performance on the tests related to presence or absence of training and to job experience.

3. How well performance on the tests related to performance on the job.

In addition, analyses were performed to determine the relationship between test performance and course grades.

Relevance of Test to Job Requirements

Of the major validation strategies, the matching of the test with industry job requirements was considered the primary thrust. For this validation, employers across the country were contacted and invited to participate as reviewers of the test outlines in their specialty area. A wide variety of sources were tapped to identify employers who would be appropriate content reviewers. Professional associations, trade associations, and numerous contacts suggested by leaders in the various fields were used. Each employer selected supervisors or other persons familiar with the job to review the performance test titles and the major areas of the job knowledge test for relevance to industry/trade requirements. Overall, the 1,600 reviewers represented all 50 states. The rating instrument used was a four-point scale that was applied to each performance test title and each area of the job knowledge test. The results of this content validation and the number of employers participating in the validation of each test are shown in Table 5. It can be seen that all of the tests have been judged quite relevant to industry/trade requirements, with most tests being rated 3.4 or above where 3 equals fairly important and 4 equals very important.

Relation of Test Scores to Training Status and Job Experience

During the field testing phase the students taking the job knowledge test included some examinees who had been in a training program for the vocational area covered by the test and some who had had no such training.

TABLE 5

Content Validity of Job Knowledge and Performance Tests

Test No.	Vocational Curriculum Areas and Test Names	Mean Rating[a]		Number of Reviewers	Number of States
		Job Knowledge	Performance		
	Agriculture				
11	Agricultural Chemicals Applications Technician	3.4	3.4	77	26
12	Farm Equipment Mechanic	3.3	3.4	74	20
	Business and Office				
21	Computer Operator	3.0	3.0	61	19
22	Word Processing Specialist	3.7	3.4	110	33
	Distributive Education				
31	Apparel Sales	3.6	3.5	46	12
32	Fabric Sales	3.4	3.2	28	13
33	Grocery Clerk	3.5	3.3	173	34
34	Hotel (Motel) Front Office	3.7	3.2	73	28
	Health				
41	Dental Assistant	3.6	3.5	158	38
42	Physical Therapist Assistant	3.5	3.7	59	12
	Home Economics				
51	Custom Sewing	3.6	3.6	21	10
52	Restaurant Service (Waiter, Waitress, Cashier)	3.5	3.5	83	27
	Technical				
61	Electronics Technician	3.5	2.9	193	36
62	Water Treatment Technician	3.3	3.4	91	21
63	Wastewater Treatment Technician	3.4	3.4	130	24
	Trade and Industry				
71	Carpenter	3.3	3.5	81	23
72	Diesel Mechanic	3.6	3.5	143	39

[a] 4 = Very important
3 = Fairly important
2 = Of Minor importance
1 = Of No importance

It was hypothesized that if the tests were valid the trained group should score higher on the job knowledge test than the untrained, and this in fact proved to be the case. The first part of Table 6 summarizes these data.

Varying amounts of job experience were represented in the employee groups tested. It was hypothesized that if the tests were valid the groups with substantial amounts of experience would score higher than those with less experience. For most of the tests where data were available, this proved to be the case, providing another kind of evidence that the tests are valid. Table 6 also summarizes the results of these analyses.

Not only does Table 6 provide evidence of the tests' relationships to training status and to job experience level, but when the "trends" across the table for each test are examined, the increase in mean test score is in the expected direction; that is, one would expect non-trained students to have scored lowest and more experienced workers to have scored highest. This is, in fact, what generally occurred for the majority of the tests. Even the deviations from this expected trend are slight and the overall picture from Table 6 is a further indication of test validity.

Relation to Job Performance

The previous section discussed the relationship between test performance and the objective criteria of training status and relevant job experience. In addition to these data, subjective evaluations of job performance were obtained from supervisors. Since the tests had been designed as modular, employers selected various performance tests to administer to some of their employees. For the most part, the selected employees took the entire job knowledge test and several performance tests. Supervisors were asked to rank these employees in terms of the quality of their job performance, and these rankings were used as the measure of job performance. Because of the burden imposed by extensive testing in the job setting, participation in the employee testing validation was less than initially hoped for. Accordingly, for six of the tests it was not possible to relate test performance with supervisors' rankings. It is interesting, however, to examine the findings for those tests for which we were able to obtain sufficient employee data. Table 7 shows the correlations between total job knowledge test score and job performance rankings.

TABLE 6

Mean Job Knowledge Test Score, Student Training Status, and Employee Experience Level

Test No.	Vocational Curriculum Areas and Test Names	Student Training Status				Employee Job-Related Experience						
		Non-Trained		Trained		Under 1 yr.		1-5 yrs.		Over 5 yrs.		Unknown
		N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
	Agriculture											
11	Agricultural Chemicals Applications Technician	50	57.0	130	65.3	-	-	-	-	3	86.3	4
12	Farm Equipment Mechanic	44	41.5	141	59.2	-	-	-	-	-	-	-
	Business and Office											
21	Computer Operator	36	43.7	152	70.6	10	82.9	37	82.5	16	87.9	29
22	Word Processing Specialist	49	87.1	204	105.6	27	112.1	36	119.0	8	108.0	7
	Distributive Education											
31	Apparel Sales	24	55.4	100	58.7	*		4	62.0	[a]		-
32	Fabric Sales	24	57.8	100	66.2	-	-	*		[a]		*
33	Grocery Clerk	36	57.5	126	61.0	6	76.8	18	78.2	22	85.0	6
34	Hotel (Motel) Front Office	44	48.0	212	60.0	*		-	-	-	-	*
	Health											
41	Dental Assistant	59	41.3	275	77.6	15	76.9	55	78.8	27	84.8	31
42	Physical Therapist Assistant	41	47.3	185	76.8	*		27	73.5	20	67.9	20
	Home Economics											
51	Custom Sewing	24	50.4	100	64.5	-	-	-	-	-	-	-
52	Restaurant Service (Waiter, Waitress, Cashier)	41	69.3	181	76.2	4	88.5	13	91.2	22	91.6	3
	Technical											
61	Electronics Technician	51	37.0	296	62.1	30	63.4	79	66.9	56	75.8	43
62	Water Treatment Technician	27	33.8	252	53.3	9	58.1	29	61.1	25	64.4	12
63	Wastewater Treatment Technician	27	43.1	252	70.2	7	82.0	67	80.0	32	80.9	33
	Trade and Industry											
71	Carpenter	53	54.7	221	70.6	5	66.6	16	77.0	12	73.9	27
72	Diesel Mechanic	38	51.2	145	78.0	5	73.0	28	76.4	20	83.6	29

[a]Too few cases

TABLE 7

Correlation Between Total Job Knowledge Score and Job Performance Ranking

Test No.	Vocational Curriculum Areas and Test Names	Correlation	Number of Employees	Number of Sites
	Agriculture			
11	Agricultural Chemicals Applications Technician	[a]		
12	Farm Equipment Mechanic	[a]		
	Business and Office			
21	Computer Operator	.35*	76	15
22	Word Processing Specialist	.48**	65	12
	Distributive Education			
31	Apparel Sales	[a]		
32	Fabric Sales	[a]		
33	Grocery Clerk	.19	46	8
34	Hotel (Motel) Front Office	[a]		
	Health			
41	Dental Assistant	.24*	114	23
42	Physical Therapist Assistant	.04	58	12
	Home Economics			
51	Custom Sewing	[a]		
52	Restaurant Service (Waiter, Waitress, Cashier)	.33	41	7
	Technical			
61	Electronics Technician	.43**	182	28
62	Water Treatment Technician	.76**	73	15
63	Wastewater Treatment Technician	.31**	131	21
	Trade and Industry			
71	Carpenter	.22	39	6
72	Diesel Mechanic	.25	59	11

*Significant at .05 level
**Significant at .01 level
[a]Number of cases too small to compute correlation

NOTE: The value of the correlation coefficient shown in this table is the weighted average of the separate within-site correlations (weighted by the number of cases).

Altogether, a total of 884 individuals participated in this validation effort. Included here were 348 Air Force uniformed personnel from 50 bases and 26 Navy uniformed personnel from 7 sites. The number of employees participating, by test, is shown in the table along with the number of sites involved. Of the 11 coefficients computed, 6 were significant at the .05 level or beyond.

Various considerations in regard to the rankings made it undesirable to treat numerically equal rankings from all sites as equivalent. In the first place is the fact that the top-ranking performer at one site might be among the lowest-ranking at another. Furthermore, a ranking of, say, "5" at a site where 40 employees were being ranked would have quite a different meaning from the same ranking where only five were being ranked. To avoid these problems, correlation coefficients were obtained separately within each site and in effect "averaged"[5] across sites.

A word of caution is in order when interpreting these correlations. There are well-recognized limitations of subjective ratings and rankings as criteria, and the correlations of the performance assessment with the test scores could, in some cases, be better regarded as evidence of whether the supervisors' assessments themselves possess any validity.

Correlations with Course Grades

During the field test, course grades in relevant courses were provided for the examinees by some of the schools. As shown in Table 8, the correlations between these grades and total scores on the tryout forms were substantial, ranging between .34 and .68.

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[5] This is equivalent to computing a single overall correlation coefficient in which the values correlated are not raw rankings but rather standardized variables with a mean of 0 and a standard deviation of 1 for each site.

TABLE 8

Correlation Between Course Grades and Total Job Knowledge Score

Test No.[a]	Vocational Curriculum Areas and Test Names	Correlation[b]	Number of Course Grades	Number of Separate Correlation Coefficients Entering into the Overall Correlation
	Agriculture			
1	Agricultural Chemicals Applications Technician	.34	81	7
2	Farm Equipment Mechanic	.59	172	8
	Business and Office			
3	Computer Operator	.46	53	3
4	Word Processing Specialist	.42	95	7
	Distributive Education			
5	Grocery Clerk	.51	43	2
6	Hotel (Motel) Front Office	.45	140	8
	Health			
7	Dental Assistant	.62	120	10
8	Physical Therapist Assistant	.46	352	27
	Home Economics			
9	Fashion/Fabric Sales and Sewing[a]	.68	30	3
10	Restaurant Service (Waiter, Waitress, Cashier)	.58	49	5
	Technical			
11	Electronics Technician	.43	352	20
12	Water/Wastewater Technician[a]	.63	61	5
	Trade and Industry			
13	Carpenter	.42	114	6
14	Diesel Mechanic	.40	97	6

[a] Field test tryout form. Tests were numbered 1 through 14. The items in Test 9 have now been split into three tests: Apparel Sales, Fabric Sales, and Custom Sewing; while the items in Test 12 have been split into Water Treatment Technician and Wastewater Treatment Technician.

[b] Correlations were computed separately for each site and course, and then averaged, weighting each correlation by the corresponding value of N - 3 where N equals the number of examinees' course grades entering into the correlation.

WORK HABITS INVENTORY

Development

The Work Habits Inventory was designed as a means for raising the competence level of students in job survival skills in the areas of positive work values, habits, and attitudes. Such skills are often not stressed in the more technical aspects of the vocational program curriculum. The use of the instrument should improve the communication between the student and the teacher with respect to the important "nontechnical" skills and can provide the basis for instruction and counseling in these areas.

In order to identify possible work habits to include in the inventory, an intensive review of the literature was undertaken, beginning with a computer search. Following the literature review, project staff undertook the development of (1) format, (2) general behavioral dimensions, and (3) specific items for the Inventory. Items were developed to tap the following general areas:

- being dependable
- giving an honest day's work
- knowing what is expected of you
- maintaining good health
- managing time and materials efficiently
- getting along with people with a variety of personalities
- working as a team member, when appropriate
- knowing your own abilities, strengths, and weaknesses
- being loyal to the organization for which you work
- making independent decisions, when appropriate
- using initiative and imagination
- working without close supervision
- working under tension or pressure
- adjusting to various work situations
- being honest
- persevering
- having appropriate personal appearance

The draft versions of the Inventory were reviewed by several members of the project's Subject Matter Review Panel and were pilot tested. Following the pilot test, items and response format were modified as necessary. The revised Inventory was then field tested in the schools participating in the administration of the "technical" portions of the tests.

Validating the Inventory was done by determining the relevance of the items of the Work Habits Inventory for each job by asking the same employers who completed the rating forms for the content validation of the job knowledge and performance tests to also participate in validating this Inventory. Because it was thought that the various statements on the Inventory would have different relevance for different jobs, analyses were performed to determine the importance of each separate item for each occupation measured by the tests. Again, a four-point scale was used by each reviewer. (4 = Very Important; 3 = Fairly Important; 2 = Of Minor Importance; 1 = Of No Importance). The results are shown in Appendix C, along with a copy of one part of the final Work Habits Inventory identifying the individual items. While an examination of this table will reveal that the occupations have different sets of "Most Important" items, the desire was to have one instrument that crossed over all the occupations tapped by the job knowledge and performance tests with a separate key of important work habits provided as part of the test package for each occupation.

There are three parts to the Inventory: one is completed by the student about his or her own traits, titled "How I Am"; another part, entitled "Importance of Job-Related Traits," also completed by the student, asks the student to estimate the importance of the job traits from an employer's point of view; and a third part, "Assessment of Student's Work Habits," is completed by the teacher about each student. All three parts contain essentially identical items; the viewpoints from which they are answered are different as indicated above. The three parts of the Work Habits Inventory are contained in the test package.

Use of Inventory

It is recommended that a three-step procedure be used. These steps are:

1. Administer the "Importance of Job-Related Traits" Inventory to new students in a vocational program. The students should indicate how important they think each behavior will be to their future employers. The Inventory would be "scored" using the appropriate "job key."

2. The results of this administration can then serve as the basis for instruction on proper work habits. This instruction should ensure that students know what the employer in the specific job area expects.

3. Later on in the school year, the student should rate his or her own behavior on the items in the "How I Am" Inventory and, at about the same time, the instructor would do the same for each student, using the "Assessment of Student's Work Habits" part of the Inventory. These individual student self-ratings can then be compared with the instructor ratings and the appropriate "scoring key," and together they would serve as a communication tool between student and teacher or between student and counselor.

PROJECT DISSEMINATION

The third objective of the Vocational Competency Measures project--to promote the acceptance and use of the occupational competency tests--required a nationwide dissemination/diffusion effort which is the subject of this section of the report. In this section, we describe the specific activities carried out to achieve the dissemination objective.

Underlying our effort was a basic philosophy that dissemination is a critical activity that continues throughout the project--from beginning to end and hopefully beyond. It is an ongoing effort that is automatically a part of other tasks. Every individual we contacted, every meeting we held or attended (whether formal or informal) to discuss the project was a form of dissemination. Contacts made as a part of other tasks, whether they were for occupational selection, verification of competency requirements, or field testing, were also part of the dissemination task. For each new contact, we provided a description of the project. In turn, these key individuals often served as referral links to leaders in other organizations. These kinds of activities occurred throughout the course of the project as a part of every major task.

Also critical to our dissemination effort was an overall strategy of involving users early and keeping the field informed. Individuals involved in the development of a project, who are kept informed about activities throughout the project, develop a personal interest and feel a part of it, thereby increasing the likelihood that the products of the project will be accepted and used. Throughout the project, many organizations requested further information about the competency tests. Some became actual participants in the field test of our measures. All were placed on our distribution list to receive periodic information bulletins on major project milestones. This list eventually grew to over 3,000 names.

The dissemination activities for the project involved a combination of people and materials. These activities are listed below and described in the paragraphs that follow:

- Project Abstract
- Project Information Brochure
- State-of-the-Art Report
- Project Update
- Journal Articles and Newsletters
- American Vocational Association Conventions
- Targeted Presentations at Meetings of Educators
- Technical Assistance to the States

Project Abstract

The project abstract was one of the very first dissemination activities to be completed by the project. It was submitted to the ED Contracting Officer during the first week of the project and was also made available to those requesting project information until the project information brochure was ready for dissemination. In addition to brief, identifying information on the project and the contractor, the abstract included an outline of project objectives, procedures, and expected contributions to education.

Project Information Brochure

The project information brochure was also one of the early dissemination activities completed by the project. It was designed for use by project staff and ED in responding to inquiries and in creating an awareness of project objectives, activities, and outcomes. The brochure was a highly appealing and significant dissemination vehicle and it served that purpose extremely well. We received many compliments on it.

The brochure provided a major contribution to project visibility and significantly enhanced our dissemination efforts. Over 15,000 copies were distributed. In addition to serving as a handout for interested individuals and as an enclosure in information mailings, it facilitated the ease with which various project tasks were completed. For example, students who participated in the pilot testing of the Work Habits Inventory received a brochure and proudly showed it to their classmates as a sign of their involvement in an important educational research project. Also, job incumbents and supervisors who were considering participating in test validation appreciated

the importance of the project and their critical role in it as a result of reading the brochure.

State-of-the-Art Report[6]

One of the major tasks that began during the early months of the project was a review of resources in the field of occupational competency measurement. While the major purpose of this review of previous research and development was to ensure that project staff capitalized on the latest experiences in developing and evaluating occupational competency measures, the highlights of this search were documented to assist others who are working, or are planning to work, in the field of competency measures for vocational education. Specifically, the intent was to provide a review of occupational competency testing, including a summary of the AIR project as well as other major efforts under way today and some of the methodological developments that should be of interest to those working in this area. Technical and legal considerations in setting test score standards are also discussed and an extensive list of references is included. This report has been distributed widely throughout the country, with over 2,000 copies disseminated by December 1982.

Project Update

Our project "Update" was a single-sheet information bulletin on important project milestones. It was a useful tool for keeping potential users informed of current activities. Fourteen issues were prepared and distributed periodically to all those on our distribution list. As mentioned previously, over 3,000 names appeared on this list. In addition, we received a number of indications that the "Update" was reproduced and copies forwarded to other individuals.

Journal Articles and Newsletters

Journal articles were submitted throughout the project both in response to specific requests from editors and on a staff-initiated basis. The purpose of the articles was to communicate project information to potentially

[6] Chalupsky, A. B., Phillips-Jones, L., & Danoff, M. N. Competency measurement in vocational education: A review of the state of the art. Palo Alto, Calif: American Institutes for Research, June 1981. (AIR-81914-6/81-RPI). (ED 205 715)

interested individuals who might not be reached by other dissemination methods. Articles about the project appeared in seven journals.

Another effective means of keeping the field informed of project activities was through news releases to various newsletters. Several benefits were derived from having project information publicized in the communication channels of interested groups: (1) these large-audience publications extended the contacts beyond those the project already had, (2) the pool of potential test sites was expanded, and (3) increased project visibility was gained which will enhance utilization of the competency tests.

A project brochure and a news release summarizing current project activities were sent to editors of appropriate educational and professional association newsletters. Articles about our project appeared in at least 25 publications that we know of. Appendix D presents a listing of journals and newsletters that have carried articles on the project.

American Vocational Association Conventions

The American Vocational Asosciation conventions attract a large number of people involved in vocational education, including those specifically interested in occupational competency testing. The conventions provided an excellent opportunity for us to distribute materials about the project, give formal presentations, hold informal gatherings, and meet individually with key people.

In December 1979, the Project Director presented a description of the project to the American Vocational Association Convention in Anaheim, California. The invited presentation was part of a theme session entitled "Are Our Students Ready for Work?...Measuring Competency." Other dissemination activities at the 1979 convention included distribution of project brochures at key exhibit booths and numerous personal contacts with individuals committed to occupational competency testing. The first meeting of the project's National Policy Council was held immediately following the convention.

In December 1981, project staff participated again in the AVA Convention in Atlanta, Georgia. The Project Director made two presentations. He participated in the New and Related Services Division Carousel of Special Interests, and also presented a status report of the project the Vocational Instructional Materials Section of the New and Related Services Division.

Targeted Presentations at Meetings of Educators

Our original dissemination plan proposed a three-day national information workshop to be conducted in the third and final year of the project (as specified in the Request for Proposal), with the expenses of approximately 163 workshop attendees paid for with project funds. After careful analysis, staff felt that the extremely wide diversity in the subject matter of the project tests and the fact that some of the tests are applicable at high school level, others at postsecondary or adult levels, and still others across the entire grade range required that the dissemination strategies be modified to be fully responsive to this diversity.

Accordingly, AIR proposed (and it was approved by ED) that, rather than have one large dissemination workshop, project staff make targeted presentations at meetings of educators who are directly concerned with one or more of the fields encompassed by our competency tests. To the maximum extent possible, these presentations were made at meetings already scheduled as part of professional association or technical specialist gatherings.

A prime focus of our project dissemination efforts was national or regional meetings of state leaders in various aspects of vocational education. Examples of such meetings where project staff made briefings include:

- New York State Commissioners Conference for Occupational Evaluation Directors, January 1980
- National Network for Curriculum Coordination in Vocational and Technical Education (NNCCVTE), July 1981 and July 1982
- Michigan School Testing Conference, March 1982
- The Utah Vocational Education Conference at Utah State University, March 1982
- Regional Coordinating Unit (RCU) Directors Annual Meeting, April 1982

- Summer Professional Improvement Conference for Vocational Education in Massachusetts, June 1982
- Nineteenth Annual Pennsylvania Department of Education Curriculum and Instruction Conference, July 1982
- New York City School District--Technical Assistance Program for Senior Vocational Education Administrators, July 1982
- Twelfth Annual All-Service Vocational Education Conference, North Dakota, August 1982
- Statewide Vocational Education Conference, Nebraska, August 1982
- Annual West Virginia Vocational Teachers Conference, August 1982
- Texas State Technical and Industrial Teachers' Workshop, August 1982
- Annual Vocational Education Workshop, Florida, August 1982
- National Joint Apprenticeship and Training Committee for Operating Engineers, September 1982
- East Central Network for Curriculum Coordination, September 1982
- Training, Education and Research Subcommittee of the Military Interservice Review Organization, September 1982
- Louisiana State Department of Education Staff meeting, September 1982
- Idaho Vocational Educators Conference, (Distributive Education and Business and Office), October 1982
- Arizona State Department of Education Staff, November 1982

Briefings on the project were also presented to the U.S. Department of Education and other interested groups in Washington, D.C. in December of 1981 and August of 1982.

In addition, project staff made presentations at some 30 professional association meetings, as shown in Appendix D. Wherever appropriate, we supplemented these presentations by meeting with cognizant staff members of state education agencies to provide technical assistance in the area of student competency testing.

With this revised strategy, we achieved far more effective coverage--both geographically and technically--than would have been possible under the originally scheduled single meeting. In fact, we were able to participate in meetings across the country, covering all regions. We accomplished this strategy at virtually the same cost that was specified in the original work statement.

Technical Assistance to the States

Technical assistance was provided to state and local education agencies largely in conjunction with briefings as part of our overall dissemination meetings as noted above. A good share of our dissemination presentations were to states recognizing the need for further training in the area of competency testing and which requested our participation in their staff meetings.

No amount of "pressure" on AIR's part could substitute for this willingness of a sufficient number of educators in a state to begin preparations for such testing. Accordingly, we avoided an arbitrary quote on in-depth technical assistance to one state in each ED region, as was originally planned. Instead, we made our project and its products known to every state and then provided whatever support services we could within the contract time and budget, upon state request.

One set of products resulting from the project will be particularly valuable both from the standpoint of technical assistance and from our goal of fostering test development on a self-supporting basis upon completion of the project. These were the four manuals designed to help vocational educators not only in improving test usage but also in developing and field testing new measures. At the request of the director of the East Central Curriculum Coordination Network, it was decided to adapt these manuals to the VECS (Vocational Education Curriculum Specialist) format for publishing by this Network as part of the VECS series developed under a previous contract with the U.S. Department of Education. As a result, the dissemination impact of the project will continue long after the current contract ends. A description of the manuals is provided in the next section.

PLANNING FOR CONTINUING COMPETENCY TEST DEVELOPMENT AND ADMINISTRATION

Field Test Site Feedback

During the field test scheduling and data collection stages, AIR project staff maintained continuing telephone and mail contact with the designated representatives of field test schools. In addition to assisting school representatives solve both the technical and logistics problems associated with test administration and helping in the revision of the individual tests, the field test feedback--looked at across all the tests--provided some valuable general information that should be taken into account in any future test development efforts. Among the "lessons" learned for achieving cooperation of field test participants were the following:

- Teachers are extremely busy and no amount of high level, administrative approvals will ensure that testing is accomplished if the teachers are not truly committed to vocational competency testing and the resulting educational benefits for their students.
- Teachers who are really committed to the measurement of vocational competency will find the time even if (or especially if) they're not pushed by the school or district administration.
- Competency testing must be kept to a reasonable time period without excessive encroachment on teaching time. Ideally, the time spent in testing will be viewed by teachers as a vital part of the educational process.
- Test content should be obviously relevant to both teachers and students.
- Test administration instructions must be kept as simple as possible.
- For teachers interested and willing to test, but who really do not have time during the regular school day, arrangements for payment for afterschool time (weekends, etc.) should be made.
- Procedures for handling the tests before, during, and after the testing should be as simple and straightforward as possible.

Suggestions for New Test Development

From the early days of the project through the field test and validation stages, we have continued to receive suggestions as to other tests that are in need of development. The suggestions range across the entire job spectrum and include the following areas:

- Drafting
- Merchandising
- Graphic Arts
- Jewelry Sales
- Jewelry Manufacturing
- Fashion Design
- Interior Design
- Secretarial Competency
- Machine Shop Operation
- Repair Parts Personnel
- Truck Driving
- Other Health Related Areas including Occupational Therapy Assistant

These suggestions typically reflected needs on the part of school or employer representatives rather than commitments to participate in the development and/or funding of new test development. In fact, based on informal contacts with educators, it is doubtful whether the currently strained state education budgets will permit any resources to be channeled to competency test development, at least in the near future. Even the purchase of existing tests, regardless of their quality, will very likely be at a level well below expectations of a few years ago. While more information needs to be obtained, it appears that employers or employer associations may be a much better source for continuing test development than school agencies, at least in the immediate future.

Follow-up Contacts with Individuals on the Project General Mailing List

In order to provide prospective test publishers with some indication of the potential market for each of the vocational competency measures, in mid-December 1982, a letter was sent to approximately 3,000 individuals and organizations on the project's mailing list describing the content of the test packages, providing a tentative estimate of test costs, and asking for an estimate of the number of test packages they think they will need in the near future. In this same mailing, individuals were asked whether they would be interested in cooperating in future test development efforts.

Within two weeks after mailing this letter, approximately 40 responses had been received despite the fact that the letters

arrived near the peak of the Christmas holiday preparations. Of those who had responded by late December, eight (20%) indicated interest in learning how their organizations can help in the development and/or funding of new tests. We expect that by the end of the VCM project we will have received a sizable number of responses indicating interest in participation in future test development as well as in the use of the current AIR tests.

Forwarding of Specimen Test Packages to State Departments of Vocational Education

In keeping with the high priority placed on dissemination in this project, it has been decided to forward a complimentary set of all 17 test packages to each State Department of Vocational Education (including the District of Columbia and the Education Departments in the outlying territories). This will be done before a publishing agreement has been completed with a test publisher.

The advance dissemination of the test packages will enable State Directors and their key staff to examine the tests and come up with sound estimates of how many tests they will need when the tests are published. These estimates will then be combined with information received from individuals on our general mailing list and will be made available to prospective publishers of our tests.

The views of State Directors of Vocational Education concerning their needs for new tests and their interest in being involved in future test efforts should also be helpful for future competency test development.

Assisting Other Agencies in Developing Vocational Competency Measures

During the early stages of the project, it was envisioned that project dissemination would not only provide technical assistance on using competency measures, but also on the development of such measures. As it turned out nearly all the education agencies requesting project assistance were much more interested in becoming aware of what was available or soon to be available in the field of competency measurement rather than in learning the specific techniques of test development. Neither the interest level nor the resources available (personnel or monetary) indicated that such technique-oriented workshops would be appropriate during the period of the VCM project.

Accordingly, it was decided to expand the test development guidebook that had been planned since the start of the project. Rather than produce a single guidebook, the decision was made to prepare four separate manuals as follows:

- Using Competency Measures Effectively

  In this module would be covered the history of competency testing, current major efforts now underway in the field, important definitions, and the many applications of vocational competency measurement in vocational education.

- Determining Requirements for Vocational Competency Measures

  Covered in this module would be answers to the question "How do you determine what to measure?" including step-by-step procedures for collecting job and task information and what should be done with all the information.

- Developing Vocational Competency Measures

  Included in this module would be a discussion of the important considerations in test development and an outline of the procedures for designing and constructing tests, beginning with the preparation of initial test specifications, through item development, pilot testing, field testing, and test revision.

- Validating Competency Tests and Using Test Results

  A discussion of the various aspects of test validity and an outline of procedures for determining and maintaining test validity would be contained in this module, along with suggestions for reporting test results and setting test standards.

It was further decided to prepare these manuals so they could be used not only as operational handbooks, but also as training modules. These modules are scheduled to be published in the near future by the East Central

Network for Curriculum Coordination[7] as part of the Vocational Education Curriculum Specialist series developed by AIR under a previous ED/OVAE project.

This series will provide "stand alone" support to educational agencies and other institutions interested in learning more not only about the potential of vocational competency measures and how to use them properly, but also how to go about planning and developing these measures. The manuals can also serve as texts or supplementary materials in training programs.

Through the distribution network of the East Central Network for Curriculum Coordination and its linkages to the National Network for Curriculum Coordination in Vocational-Technical Education (NNCCVTE), the project experiences in test development will be available to all states long after the completion date of the VCM project.

Hopefully in the next few years, the technical and financial resources of educational agencies will be much more capable of supporting individual or cooperative efforts in vocational competency test development. As of now, however, we know of wide-scale development and evaluation of vocational competency tests only in Florida and the several states participating in the Student Occupational Competency Achievement Testing (SOCAT) Consortium.[8]

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[7] For ordering and price information, contact Ms. Rebecca Douglass, Director, East Central Curriculum Coordination Center, Sangamon State University, E-22, Springfield, IL 62708.

[8] For further information on the test development in Florida, contact Dr. Roy Giehls, Program Director, Evaluation Section, Division of Vocational Education, Florida Department of Education, Tallahassee, FL 32301. For information on SOCAT, contact Dr. Gordon McMahon, National Occupational Competency Testing Institute, 45 Colvin Avenue, Albany, NY 12206.

APPENDIX A

Members of the National Policy Council and the National Subject Matter Panel

National Policy Council Members

Mr. Ingo Antonitsch
Executive Director of City and
County of Denver Commission of
the Disabled

Dr. Thomas M. Bogetich
Executive Director
California Advisory Council on
Vocational Education

Dr. Ralph C. Bohn
Dean of Continuing Education
San Jose State University

Dr. Ralph Bregman
The National Advisory Council on
Vocational Education

Dr. Donald M. Clark
President, National Association
For Industry-Education Cooperation

Mr. Eustaquio Cortez
Automotive Department
Evergreen Community College
San Jose, California

Dr. Esther E. Diamond
Senior Project Director
Science Research Associates
Chicago, Illinois

Dr. Carol Eliason
American Association of Community
and Junior Colleges

Mr. Reese Hammond
Director of Education & Training
International Union of Operating
Engineers, AFL/CIO

Dr. Addison S. Hobbs, Director
Vocational-Technical Education,
State of Maryland

Dr. Marion B. W. Holmes
Director of Vocational Education
School District of Philadelphia

Mr. George Kosbab
Assistant Director
Curriculum and Staff Development
Ohio State Department of Education

Ms. Wilma Ludwig
State Director of Vocational Education,
New Mexico

Ms. Judith McKeever
Nursing Assistant Program
916 Area Vocational-Technical Institute
White Bear Lake, Minnesota

Mr. Philip W. Osborne, General
Manager (Retired), Industrial Relations
Aluminum Company of America

Dr. Gordon I. Swanson
Professor of Vocational Education
Past President, American Vocational Assoc.
University of Minnesota

Dr. Robert J. Thompson
Vice President, American Vocational Assoc.,
Region V
Foothill-DeAnza Community College District
Los Altos Hills, California

National Subject Matter Panel

Agriculture Education

Mr. Paul Day, State Supervisor,
Agriculture Education
Minnesota State Department of
Education

Mr. John Murray
Jackson Area Vocational-Technical
Institute
Minnesota

Business and Office Education

Dr. Robert Poland
Coordinator of Vocational, Technical,
and Applied Arts Education
Michigan State University

Mr. John Lee
Chief State Consultant, Business
Education
Indiana State Department of Public
Instruction

Distributive/Cooperative Education

Dr. Robert L. Bennett
Director of Planning and Development
San Mateo County Community College
District, San Mateo, California

Ms. Elinor Burgess
County Supervisor, Distributive
Education
Fairfax County Public Schools,
Virginia

Health Occupational Education

Dr. Mildred Pittman, Coordinator
Health Occupations Education
School of Education, University of
Indiana

Ms. Roberta Firetag
San Jose City College
San Jose, California

Home Economics Education

Dr. Mary Ann Parthum
Denver Public Schools

Dr. Hazel Crain
Center for Business and Vocational
Teacher Education
University of Nebraska-Lincoln

Technical Education

Dr. Robert Keck
State Supervisor of Technical Education
Oklahoma State Regents for Higher
Education

Dr. George Mehallis
Executive Director for Technical Education
Broward Community College
Miami, Florida

Trade and Industry Education

Mr. Ross Alloway
Rosston Schools of Men's Hair Design
Long Beach, California

Mr. Robert Patterson, Director
Vocational Industrial Education
Texas Education Agency

APPENDIX B

Schools Participating in Pilot Testing

Schools Participating in Pilot Testing

Test Name	School and Location
Agricultural Chemicals Applications Technician	Delta Community College, Stockton, California
Farm Equipment Mechanic	Delta Community College, Stockton, California
Computer Operator	Richmond Regional Occupational Center, California Computer Technology School, Pittsburgh, Pennsylvania
Word Processing Specialist	ICM School of Business, Pittsburgh, Pennsylvania Foothill College, Los Altos Hills, California
Grocery Clerk	Eden Area Regional Occupational Center, San Lorenzo, California
Hotel (Motel) Front Office	City College of San Francisco, Hotel and Restaurant Management Program
Dental Assistant	Foothill College, Los Altos Hills, California University of Pittsburgh, School of Dental Medicine
Physical Therapist Assistant	Tarrant Junior College, Hurst, Texas DeAnza College, Cupertino, California
Apparel Sales, Fabric Sales, Custom Sewing	Solano Community College, Suisun, California Clarrisa School, Pittsburgh, Pennsylvania
Restaurant Service (Waiter, Waitress, Cashier)	Sequoia High School, Redwood City, California
Electronics Technician	Penn Technical Institute, Pittsburgh, Pennsylvania Monterey Peninsula College, Monterey, California
Water Treatment Technician, Wastewater Treatment Technician	Palo Alto Treatment Facility, California
Carpenter	San Jose Regional Occupational Center (partially) Laney Community College, Oakland, California Mercer County Area Voc/Tech Schools, Trenton, New Jersey
Diesel Mechanic	Hayward Unified School District (Regional Occupational Center), Hayward, California Mercer County Area Voc/Tech Schools, Trenton, New Jersey

APPENDIX C

1. Work Habits Inventory: Assessment of Student's Work Habits
2. Work Habits Inventory Mean Importance Ratings of Items

ASSESSMENT OF STUDENT'S WORK HABITS

Student's Name _____

DIRECTIONS: Please indicate the extent to which each of the descriptions below applies to this student. Mark answer space 1, 2, 3, or 4, as shown.

1. Mark answer space 1 if the description almost never applies to this student.
2. Mark answer space 2 if the description occasionally applies to this student.
3. Mark answer space 3 if the description frequently applies to this student.
4. Mark answer space 4 if the description almost always applies to this student.

Circle one number in each row (Almost Never … Almost Always)					Circle one number in each row (Almost Never … Almost Always)				
1	2	3	4	1. Performs duties effectively with a minimum of supervision.	1	2	3	4	26. Shows up at school ready to work.
1	2	3	4	2. Is able to work with people of various backgrounds.	1	2	3	4	27. Seeks information about responsibilities when in doubt.
1	2	3	4	3. Maintains self control in difficult situations.	1	2	3	4	28. Makes independent decisions, when necessary.
1	2	3	4	4. Doesn't make fun of others.	1	2	3	4	29. Shows patience when teaching others.
1	2	3	4	5. Works without being easily distracted.	1	2	3	4	30. Does not distract or annoy others.
1	2	3	4	6. Organizes work to make best use of time.	1	2	3	4	31. Comes to school on the days scheduled.
1	2	3	4	7. Is tactful when pointing out mistakes of others.	1	2	3	4	32. Is eager to learn about new developments and ways of doing things.
1	2	3	4	8. Avoids "badmouthing" the school.	1	2	3	4	33. Does fair share of the work.
1	2	3	4	9. Does acceptable work in the absence of supervision.	1	2	3	4	34. Adapts work habits to changes in rules, procedures, and situations.
1	2	3	4	10. Accomplishes tasks as scheduled.					
1	2	3	4	11. Does not take equipment from others without permission.	1	2	3	4	35. Is careful not to endanger the safety of others.
1	2	3	4	12. Is cheerful and friendly toward other students.	1	2	3	4	36. Shows a friendly interest in other people.
1	2	3	4	13. Meets performance expectations even if these require extra effort beyond what is normally expected.	1	2	3	4	37. Follows appropriate school safety regulations.
					1	2	3	4	38. Demonstrates a positive attitude toward school.
1	2	3	4	14. Follows instructions willingly.					
1	2	3	4	15. Asks questions or asks for help when needed.	1	2	3	4	39. Gets work done on time.
1	2	3	4	16. Wears clothes that are consistent with school requirements.	1	2	3	4	40. Sets a good example for other students.
1	2	3	4	17. Works well in a team, when required.	1	2	3	4	41. Follows school rules about attendance, tardiness, etc.
1	2	3	4	18. Does not waste materials or supplies.	1	2	3	4	42. Maintains personal appearance that is suitable for the school.
1	2	3	4	19. Communicates effectively to fellow students and teacher(s).	1	2	3	4	43. Comes to school on time.
1	2	3	4	20. Gets work done, despite difficulties.	1	2	3	4	44. Makes an effort to meet others half way in conflict situations.
1	2	3	4	21. Uses slack time productively without waiting for directions from teacher.	1	2	3	4	45. Accepts responsibility for task and follows through with a minimum of supervision.
1	2	3	4	22. Sticks with a task until it is finished.	1	2	3	4	46. Volunteers to help when there is a crisis or heavy work load.
1	2	3	4	23. Accepts responsibility for own errors.	1	2	3	4	47. Notifies appropriate individuals if unable to come to school as scheduled.
1	2	3	4	24. Shows cooperation and consideration in working with others.	1	2	3	4	48. Responds well to suggestions for improvement.
1	2	3	4	25. Takes good care of tools and equipment.	1	2	3	4	49. Is able to adjust to new and different work situations.

Work Habits Inventory
Mean Importance Ratings of Items
(N = Number of Reviewers)

Item Number	Agricultural Chemicals Applications Technician (N=33)	Farm Equipment Mechanic (N=20)	Computer Operator (N=24)	Word Processing Specialist (N=42)	Apparel Sales (N=13)	Fabric Sales (N=12)	Grocery Clerk (N=72)	Hotel (Motel) Front Office (N=27)	Dental Assistant (N=82)	Physical Therapist Assistant (N=42)	Custom Sewing (N=05)	Restaurant Service (Waiter, Waitress, Cashier) (N=24)	Electronics Technician (N=73)	Water Treatment Technician (N=30)	Wastewater Treatment Technician (N=44)	Carpenter (N=36)	Diesel Mechanic (N=56)
1	3.59	3.77	3.58	3.72	3.67	3.60	3.51	3.61	3.74	3.86	3.60	3.46	3.68	3.74	3.70	3.50	3.55
2	2.91	3.05	3.08	3.30	3.87	3.80	3.46	3.46	3.57	3.63	3.00	3.54	3.26	2.94	3.11	3.29	3.07
3	3.56	3.68	3.54	3.58	3.80	3.73	3.72	3.82	3.84	3.98	3.60	3.75	3.51	3.61	3.50	3.29	3.56
4	2.91	3.27	2.81	3.37	3.67	3.79	3.25	3.26	3.49	3.64	3.60	3.38	3.05	2.71	2.73	2.97	2.93
5	3.21	3.45	3.31	3.60	3.33	3.60	3.41	3.21	3.37	3.41	3.60	3.25	3.33	3.03	3.11	3.38	3.41
6	3.52	3.64	3.42	3.70	3.53	3.67	3.64	3.50	3.67	3.76	3.60	3.54	3.57	3.32	3.39	3.59	3.71
7	3.26	3.50	3.15	3.65	3.40	3.53	3.38	3.46	3.52	3.57	3.60	3.29	3.30	3.39	3.05	3.12	3.13
8	3.38	3.77	3.35	3.47	3.80	3.73	3.71	3.71	3.73	3.60	3.40	3.79	3.53	3.26	3.05	3.53	3.57
9	3.62	3.73	3.77	3.74	3.73	3.73	3.55	3.59	3.55	3.90	4.00	3.46	3.73	3.77	3.73	3.56	3.70
10	3.65	3.45	3.77	3.77	3.40	3.47	3.67	3.50	3.51	3.76	3.80	3.75	3.49	3.58	3.63	3.74	3.52
11	3.15	3.41	3.12	3.24	2.67	3.07	3.09	2.82	2.95	3.17	3.60	3.13	3.42	3.00	3.09	3.56	3.56
12	3.21	3.32	2.88	3.26	3.67	3.60	3.46	3.46	3.63	3.40	2.80	3.50	2.99	2.94	2.89	3.09	3.04
13	3.47	3.18	3.38	3.58	3.53	3.47	3.36	3.43	3.38	3.44	3.40	3.21	3.26	3.26	3.23	3.29	3.45
14	3.65	3.86	3.69	3.77	3.73	3.67	3.75	3.71	3.74	3.74	3.60	3.63	3.51	3.68	3.55	3.71	3.59
15	3.79	3.64	3.85	3.84	3.60	3.80	3.62	3.86	3.55	3.90	3.60	3.46	3.72	3.68	3.61	3.65	3.73
16	3.24	3.14	2.73	2.88	3.53	3.67	3.53	3.61	3.39	3.44	2.60	3.75	3.04	2.84	2.84	3.38	3.23
17	3.32	3.45	3.50	3.53	3.40	3.73	3.52	3.68	3.73	3.81	3.40	3.67	3.42	3.23	3.58	3.53	3.52
18	3.47	3.59	3.23	3.26	3.40	3.33	3.63	3.21	3.39	3.24	3.60	3.67	3.48	3.16	3.39	3.53	3.57
19	3.53	3.64	3.58	3.67	3.60	3.73	3.53	3.68	3.60	3.88	3.40	3.50	3.53	3.55	3.59	3.29	3.43
20	3.35	3.55	3.48	3.63	3.60	3.60	3.57	3.61	3.54	3.69	3.80	3.46	3.58	3.58	3.43	3.44	3.56
21	3.47	3.50	3.42	3.44	3.73	3.67	3.53	3.61	3.48	3.40	4.00	3.38	3.51	3.23	3.30	3.47	3.45
22	3.50	3.59	3.65	3.62	3.33	3.60	3.55	3.68	3.55	3.73	3.80	3.67	3.71	3.35	3.36	3.74	3.69
23	3.53	3.59	3.69	3.70	3.47	3.80	3.57	3.75	3.56	3.83	3.80	3.54	3.68	3.52	3.61	3.59	3.70
24	3.32	3.36	3.35	3.65	3.60	3.47	3.53	3.61	3.68	3.70	3.60	3.58	3.42	3.26	3.41	3.53	3.50
25	3.71	3.77	3.65	3.72	3.53	3.40	3.53	3.24	3.74	3.60	3.80	3.42	3.72	3.32	3.64	3.59	3.72
26	3.79	3.86	3.77	3.77	3.87	3.87	3.92	3.83	3.83	3.74	3.80	3.92	3.68	3.84	3.82	3.94	3.89
27	3.56	3.45	3.58	3.60	3.53	3.67	3.66	3.69	3.57	4.00	3.40	3.42	3.38	3.58	3.61	3.47	3.56
28	3.24	3.36	3.23	3.[illegible]	3.07	3.27	3.12	3.48	3.31	3.48	3.60	3.08	3.59	3.58	3.43	3.29	3.39
29	2.82	3.18	3.12	3.30	3.27	3.40	3.30	3.31	3.36	3.69	3.60	3.25	3.31	3.13	3.05	3.00	3.14
30	2.97	3.50	3.42	3.56	3.53	3.53	3.47	3.28	3.43	3.48	3.20	3.08	3.41	3.23	3.07	3.35	3.34
31	3.70	3.82	3.92	3.84	3.87	3.87	3.92	3.79	3.89	3.86	3.60	3.92	3.84	3.81	3.89	3.94	3.89
32	3.50	3.64	3.36	3.40	3.40	3.40	3.34	3.34	3.56	3.43	3.40	3.29	3.44	3.03	3.21	3.32	3.55
33	3.35	3.59	3.65	3.72	3.73	3.60	3.62	3.55	3.68	3.64	3.60	3.63	3.64	3.58	3.59	3.74	3.65
34	3.32	3.36	3.50	3.60	3.67	3.80	3.58	3.66	3.51	3.60	3.40	3.54	3.43	3.48	3.55	3.56	3.56
35	3.79	3.95	3.65	3.44	3.47	3.67	3.70	3.62	3.69	3.98	3.80	3.83	3.79	3.84	3.98	3.91	3.91
36	2.74	3.14	2.69	2.86	3.60	3.60	3.36	3.52	3.51	3.24	2.80	3.46	2.81	2.71	2.77	2.79	2.95
37	3.88	3.82	3.73	3.44	3.40	3.60	3.63	3.45	3.62	3.98	3.80	3.71	3.68	3.84	3.95	3.94	3.86
38	3.52	3.77	3.23	3.37	3.67	3.67	3.67	3.62	3.75	3.44	3.40	3.58	3.43	3.19	3.16	3.56	3.65
39	3.68	3.41	3.77	3.86	3.40	3.40	3.68	3.52	3.49	3.52	3.80	3.67	3.53	3.48	3.64	3.65	3.60
40	3.24	3.32	3.23	3.33	3.47	3.67	3.51	3.36	3.48	3.38	3.40	3.43	3.20	3.16	3.09	3.35	3.40
41	3.42	3.64	3.58	3.58	3.80	3.73	3.63	3.52	3.64	3.67	3.40	3.58	3.60	3.48	3.70	3.53	3.70
42	2.97	3.36	2.88	2.93	3.67	3.80	3.57	3.52	3.66	3.43	3.20	3.79	3.03	2.97	2.73	3.06	3.14
43	3.68	3.73	3.77	3.74	3.93	3.80	3.95	3.86	3.82	3.67	3.60	3.88	3.64	3.71	3.86	3.97	3.86
44	3.06	3.36	3.15	3.35	3.60	3.53	3.28	3.36	3.46	3.48	3.60	3.00	3.22	3.32	3.18	3.09	3.18
45	3.47	3.73	3.65	3.70	3.47	3.67	3.54	3.72	3.60	3.90	3.80	3.50	3.65	3.81	3.66	3.44	3.68
46	3.24	3.32	3.38	3.51	3.33	3.47	3.28	3.48	3.59	3.60	3.80	3.25	3.29	3.16	3.25	3.38	3.18
47	3.70	3.68	3.88	3.77	3.87	3.93	3.92	3.86	3.84	3.93	3.80	3.88	3.77	3.77	3.82	3.97	3.88
48	3.29	3.50	3.38	3.44	3.67	3.73	3.49	3.41	3.64	3.55	3.60	3.42	3.47	3.32	3.23	3.29	3.39
49	3.24	3.36	3.54	3.56	3.60	3.73	3.45	3.55	3.55	3.[illegible]	3.60	3.38	3.49	3.52	3.33	3.35	3.42

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Journal Articles and Newsletters

Articles about the Vocational Competency Measures Project appeared in the following journals and newsletters:

- VocEd (Journal of the American Vocational Association)
- School Shop
- Journal of the American Personnel and Guidance Association
- Journal of Industry-Education Cooperation
- Journal of the American Technical Education Association
- Center Critiques (The East Central Network for Curriculum Coordination)
- CAPTRENDS
- Journal of the American Physical Therapy Association
- Education Daily
- Report on Education Research
- Vocational Education and ManPower Weekly
- Education and Work
- Update (American Vocational Association)
- Guidepost (American Personnel and Guidance Association)
- News Exchange (Association for Supervision and Curriculum Development)
- Newsletter (National Vocational Guidance Association)
- Newsnotes (Association for Measurement and Evaluation in Guidance)
- Centergram (National Center for Research in Vocational Education)
- Career Education News
- National Report for Training and Development (American Society for Training and Development)
- Educational Measurement
- Data Processing Digest
- NATTS News (National Association of Trade and Technical Schools)
- Newsletter (American Apparel Manufacturing Association)

- Industrial Relations Bulletin (American Electronics Association)
- Open Entries (The Center for Studies in Vocational Education)
- Newsletter (Niagara Frontier Industry Education Council, Inc.)
- Implement and Tractor
- American Fabrics and Fashion Magazine
- Newsletter (Greater Providence Chamber of Commerce)
- Newsletter (Phi Delta Kappa)
- Electronic Servicing and Technology
- Newsletter (American Association of Women Dentists)
- Career Planning and Adult Development Newsletter
- Newsletter (National Association of Industry-Education Councils)
- Restaurant Hospitality
- Newsletter (Wayne County Intermediate School District)
- Apparel Industry Magazine
- Linkages (National Institute for Staff and Organizational Development)

Presentations to Selected Professional Organizations

Presentations about the Vocational Competency Measures project were made to the following professional organizations:

- California Association of Program Evaluators, March 1980
- American Personnel and Guidance Association, April 1981
- California Water Pollution Control Association, November 1981
- Association of Health Career Schools, January 1982
- Fourth International Learning Congress of the Society for Applied Learning Technology, February 1982

- Michigan Association for Measurement and Evaluation in Guidance, March 1982
- Eighth Annual Convention of the Vocational Education Association of New Jersey, March 1982
- California Community Colleges, March 1982
- Wisconsin Vocational Education Association, March 1982 (materials displayed)
- AVA Region V Leadership Conference, March 1982 (materials displayed)
- American Association of Community and Junior Colleges, April 1982
- American Technical Education Association, April 1982
- California Community Colleges Gender Equity Conference for Vocational Education, April 1982
- New Jersey Vocational Education Association, April 1982
- California Association of Vocational Educators, April 1982
- Business Education Association of Metropolitan New York, May 1982
- West Virginia Vocational Administrators, May 1982
- National Vocational Home Economics Association, May 1982
- American Physical Therapy Association, June 1982
- California Association of Health Careers Educators, June 1982
- Michigan Occupational Education Association, August 1982
- West Virginia Vocational Teachers Association, August 1982
- Alabama Association of Secondary Vocational Educators, August 1982
- International Union of Operating Engineers, September 1982
- Military Interservice Review Organization, September 1982
- Idaho Vocational Educators Association, November 1982